National Institute on Alcohol Abuse and Alcoholism

Alcohol and the Brain: An Overview

Alcohol interferes with the brain's communication pathways and can affect the way the brain looks and works. Alcohol makes it harder for the brain areas controlling balance, memory, speech, and judgment to do their jobs, resulting in a higher likelihood of injuries and other negative outcomes. Long-term heavy drinking causes alterations in the neurons, such as reductions in their size. Below are a few key topics related to alcohol and the brain.

The Adolescent Brain

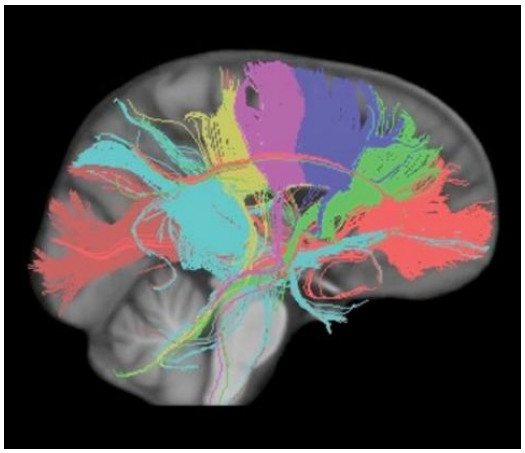
Adolescent brains are more vulnerable to the negative effects of alcohol than adult brains. Misuse of alcohol during adolescence can alter brain development, potentially resulting in long-lasting changes in brain structure and function.

Alcohol-Induced Blackouts

Alcohol misuse can cause alcohol-induced blackouts. Blackouts are gaps in a person's memory of events that occurred while they were intoxicated. These gaps happen when a person drinks enough alcohol that it temporarily blocks the transfer of memories from short-term to long-term storage—known as memory consolidation—in a brain area called the hippocampus.

Alcohol Overdose

Continuing to drink despite clear signs of significant impairments can result in an alcohol overdose. An alcohol overdose occurs when there is so much alcohol in the bloodstream that areas of the brain controlling basic life-support functions—such as breathing, heart rate, and temperature control—begin to shut down. Symptoms of alcohol overdose include mental confusion, difficulty remaining conscious, vomiting, seizure, trouble breathing, slow heart rate, clammy skin, dulled responses (such as no gag reflex, which prevents choking), and extremely low body temperature. Alcohol overdose can lead to permanent brain damage or death.



Diffusion tensor imaging (DTI) of fiber tracks in the brain of a 58-year-old man with alcohol use disorder. DTI maps white-matter pathways in a living brain.

Image courtesy of Adolf Pfefferbaum, M.D., Ph.D., and Edith V. Sullivan, Ph.D.

Prenatal Alcohol Exposure

Prenatal alcohol exposure can cause brain damage, leading to a range of developmental, cognitive, and behavioral problems, which can appear at any time during childhood. Alcohol can disrupt fetal development at any stage during a pregnancy—including at the earliest stages and before a woman knows she is pregnant.

Alcohol Use Disorder

As individuals continue to drink alcohol over time, progressive changes can occur in the structure and function of their brains. These changes can compromise brain function and drive the transition from controlled, occasional use to chronic misuse, which can be difficult to control and lead to alcohol use disorder (AUD). Individuals with moderate to severe AUD may enter a cycle of alcohol addiction. The extent of the brain's ability to return to normal following long-term sobriety is not fully understood, but a growing number of studies indicate that at least some AUD-induced brain changes—and the changes in thinking, feeling, and behaving that accompany them—can improve and possibly reverse with months of abstinence from drinking. (More detail about the neuroscience of AUD is provided in the Neuroscience: The Brain in Addiction and Recovery section of *The Healthcare Professional's Core Resource on Alcohol*.)

For more information about alcohol and brain health, please visit the Alcohol and the Brain topic page.